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Understanding the Use of Questioning by Mathematics Teachers: A revelation

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This article investigates perceived existing classroom practices in mathematics pedagogy and the impact on Nepalese mathematics teachers' understanding and uses of questioning. For this study, a narrative inquiry approach has been used to focus on the experiences of six mathematics teachers working in schools in Kathmandu Valley, Nepal. A criterion-based selection strategy was used to choose research participants for this research (Roulston, 2010). This article aims to examine the complexities of mathematics classroom experiences by gaining insight into the use of questioning. This inquiry utilizes a variety of theoretical lenses, including sociological perspectives and behaviorists through constructivist approaches to categorize questioning using the criteria of expertise, critical pedagogical perspectives and algorithmic and daily life practices. Through this methodological approach an analysis of relative power relations in mathematics classroom established through teacher perspective in questioning is made. This study is framed through the research question: How do teachers narrate their experience of understanding and usage of questioning in relation to mathematics pedagogy? Subscribing to a narrative inquiry for meaning-making, this article thus studied six mathematics teachers' voices and experiences to explore classroom power relationship in the context of whose experiences are valued and whose voice can be heard in during student questioning. In conclusion it was found that the majority of the studied mathematics teachers seem to be conformist to a perceived appropriate method of questioning at the beginning of their teaching career but become nonconformist, defined as being more flexible in questioning technique later in their career. Further it was found that the majority of the research participants asked more questions within the simple to complex level with greater focus on simple (low level) questioning due to a belief that this encourages students to engage in mathematical discussion.

Keywords: *pedagogy, questioning, criterion-based selection, narrative inquiry, conformist, mathematical discussion*

Introduction

This article is drawn from one section of the first author's (Niroj) M Phil dissertation in mathematics education under the principal supervision of Bal Chandra Luitel and co-supervision of Binod Prasad Pant. The article describes classroom practices in mathematics pedagogy specific to the understanding and use of questioning by mathematics teachers. A narrative inquiry approach has been used to focus on the experiences of six mathematics teachers working in schools in Kathmandu Valley, Nepal. In this article, we present an introduction, supporting literature(s), theoretical references, methodology, discussion of findings and their implications and draw conclusions.

The aim of this article is to explore mathematics teachers' understanding and use of questioning in the mathematics classroom. Questioning has been identified as one of the most frequent teaching and learning strategies in mathematics classroom but has remained under-researched, particularly with regards to teachers' understanding and use of questioning in Nepalese mathematics classrooms (Dahal, 2017). Of particular note is the observation that a mathematics classroom is a context where socio-cultural practices also take place. Within a social-cultural perspective then, this research article acknowledge that learning is possible when individuals interact and get involved in the discussion (Vygotsky, 1978). It follows then that the sociocultural viewpoint of both the teacher and students respectively influence the social and cultural interactions in a mathematics classroom. This consideration of the context of classroom practices through a sociocultural perspective emphasizes language as a meaningful part of the culture and a unique criterion from which individuals form their thinking through questioning. Moreover, it has become evident through this research that to achieve further meaning-making, teachers need to ask questions according to the cognitive level of the students, adopt behaviors similar to those of their students and provide equal access and opportunity to all of their students to respond to questions.

The 21st century mathematics teacher, teacher educator and educational researcher must explore recent trends in mathematics classroom teaching practices. Teachers, who use a student-centered model for instruction, believe that the students are active participants in constructing knowledge as opposed to the practice of passively receiving knowledge from a teacher (Seung, Park & Narayan, 2011). It follows then that student-centered instruction is necessary to be adopted by teachers to offer opportunities for students to build knowledge through experience (Polly, 2014). Classroom communication in mathematics teaching and learning is thus an essential factor (Dahal, 2013), and specifically questioning, is an important experience to be taken into consideration within this context. A teacher's questions are intended to be used as a guide for instruction towards an appropriate learning goal as well as to extend and solidify students' understanding of a particular topic (Chin, 2007).

Effective mathematics teaching then requires an understanding of what students need to learn and know and subsequently how to challenge and support them to learn well (NCTM, 2018). In this regard, NCTM (2018) has explained how to accomplish this by stating that teachers need to know what questions to ask to both engage and differentiate learning for a diverse range of student knowledge. Cotton (1989) states that questioning is one of the primary and most influential teaching skills that teachers can use in a mathematics classroom. As the primary researcher of this study, I note that my own lived

mathematics classroom experience frequently employed the strategy of questioning for instruction due to my belief that it is the most important tool to help students develop confidence and understanding.

Further, the findings of Edwards and Bowman (1996) are worth consideration: the teachers' questioning has been found to be a crucial part of mathematics classroom interaction, which seems to be significant to enable teachers to identify students' need in mathematics. In this regard, a teachers' major instructional strategy should be the use of a variety of questions to determine whether students are aware of what they are going to learn in mathematics. While, mathematics teachers use different categories of skills such as problem-solving, critical thinking and reasoning in their teaching they are not always aware of which skills are really helpful to the students in the study of mathematics (Sahin, Bullock & Stables, 2002). Caram and Davis (2005) found that when teacher questioning is efficacious, they can improve student learning through the development of critical thinking skills, reinforcement of understanding, error correction and feedback. This research about how mathematics teachers ask questions their classroom lesson can influence mathematics teacher pedagogy.

Further, Croom and Stair (2015) also posit that classroom questions in mathematics are the best used experimental teaching and learning tools to facilitate student academic improvement and to judge student critical thinking. This view was also supported by Vogler (2005) who stated that questioning can help to make connections to earlier knowledge and can inspire cognitive expansion. In addition Hill and Fly (2008) state that the problems related to teachers' questioning in mathematics classroom are a result of the failure of mathematics teachers to consider student' capacity resulting frequently in not well organized questions that do not strengthening student understanding (Luitel, 2009). In our view, mathematics teachers require awareness of the types of questions, approaches and the art of questioning in order to strengthen students' understanding and hence, this research could be a revelation for all mathematics teachers.

Nepalese Issues in Classroom Questioning in Mathematics

The global emphasis on 21st-century higher order thinking skills, specifically problem-solving, critical thinking and reasoning must be reflected in mathematics pedagogy in order to foster student abilities to engage in mathematical reasoning. Teacher questioning is an essential component to engage students as active participants in the learning process because questioning techniques can be helpful for encouraging and promoting student reasoning ability (Van Zee & Minstrell, 1997). However the research on questioning in mathematics classrooms indicates that 93% of teacher questions are "lower level" knowledge-based questions focusing on recall of facts. Little wonder then that generally student performance in mathematics is unsatisfactory.

A teacher's repertoire must include both adequate subject specific content and pedagogical knowledge. As outlined above, essential pedagogical knowledge for teachers entails an understanding of not only the types of questioning strategies, for example, starter questioning, questioning to encourage mathematical thinking, assessment questioning and discussion questioning, that engage students in mathematical conversations but also knowledge and expertise with how to scaffold learning to support students.

To facilitate classroom discussion then a mathematics teacher must be familiar with a framework for categorizing questioning that provides a guideline or techniques for asking productive questions and illustrates how productive norms in the classroom are established by the use of questioning (Goos, 2004). In this regard, Cotton (1989) summarized the relevant research about types of questions and clarified the existence of a dualistic system. Namely that there are two general types of teacher questions in mathematics classroom: low-level and high-level. Low-level questions are also known as closed, direct, knowledge and recall questions. Alternatively, high-level questions are open-ended, interpretive, evaluative, probing, inferential, emerging and synthesis-based. Additionally Goos (2004) emphasized the need for teachers to allow "wait time" for responses from students. When teachers allow processing time students have the opportunity to respond using higher levels of thinking. Substantial research has addressed how to start and end a discussion (Soucy McCrone, 2005) and this information contributes to the knowledge base in mathematics education with respect to teacher questioning and discourse and the consequent promotion of deep level of student learning.

Mathematics teachers, educational researchers and teacher trainers, have expressed growing concern about inadequate levels of student performance in mathematics in SLC (School Level Certificate), now named as SEE (Secondary Education Examination) in Nepal. This research indicates that mathematics teachers do not necessarily plan for questioning rather asking habitual questions without considering the student audience, contributing to the complexity of achieving success in the mathematics classroom. The posing of a set of questions that do not cater to the individual needs of students is seen as a major factor in the decline of performance in mathematics. One of many reasons attributed to this failure may be the inadequacy of the nature and uses of questioning which consequently may restrain student critical thinking and logical reasoning.

As per the first authors' recent Nepalese context teaching and learning experience, the role generally played by their teachers to develop student personal mathematics confidence and competence through questioning appears to be insufficient. In fact the failure by some mathematics teachers to ask suitable questions in the mathematics classroom may have an adverse effect on student performance. Of particular note is the prior assumption that some mathematics teachers make that students already know something about the topics that comprise the mathematics curriculum. Further, some mathematics teachers do not possess strong content knowledge and have problems in preparing suitable questions for learners (Danielson, 1996). Hence the focus of this research article on the exploration of mathematics teacher understanding and use of questioning by mathematics teachers. It may be due to inadequate understanding and uses of questioning practices by mathematics teachers.

Supporting Literatures

Questioning in mathematics. In general, questioning occurs when a problem or dilemma is presented to a student in anticipation of their answers. In this regard, Seime (2015, p. 5) defined a question as "a statement for which a reply is expected". From this

idea, it can be further stated that the word “questioning” refers to any idea that requires a response from the learner in the mathematics classroom. So, questioning within educational circles has been in existence from time immemorial. Questioning has been used to provide a variety of situations that increase student involvement, regulate classroom processes, focus attention on a particular issue or concept, structure a task in order to maximize learning and understanding, assess students’ prior and current knowledge and to determine whether the tasks assigned have been achieved or not in mathematics classroom (Callahan & Clark, 2014). Thus, subscribing to the view that questioning is essential to mathematics pedagogy, first author have started this section with four goals in mind: clarifying the notion of Socratic questioning, explaining the concept of verbal jigsaw, unpacking logical thinking and framing questioning. Firstly, Socratic questioning references the great philosopher Socrates who used searching questions to inspire his students to think, clarify and justify their claims (Newton, 2012; Harrop & Swinson, 2013). Socratic questioning involves the inclusion of questions that assist in promoting and guiding student thinking and includes such subcategories as pumping, reflective toss and constructive challenge. Secondly, the verbal jigsaw is a technique used to focus on key concepts using content-specific terminology. Subcategories for verbal jigsaw include association of key concepts and verbal close. Thirdly, logical thinking is facilitated by questioning that helps students construct a conceptual framework. Subcategories of logical thinking are multi-divided questioning, stimulating multi-modal thinking and focusing and zooming mathematical ideas. The final category, framing is used to develop a problem or discussion topic and to frame the discussion. Subcategories of framing questioning are: introduction, outline and summarizing.

Questioning and critical thinking. In the Nepalese context, the potential impact of critical thinking is considerable and can be used to compare the dynamic relationship between how students learn and how teachers teach mathematics (Mason, 2010). The use of critical thinking in mathematics classroom pedagogical design can vary from no evidence to use as an essential tool for student engagement. The ability to differentiate between a statement of reality, an opinion or an assumption of either or both mathematics teachers and students is an important critical thinking skill classroom teaching and learning. It is necessary to be able to discern what can be directly verified, what is a legitimate suggestion derived from the facts and hence what to include in mathematics classroom questioning. Critical thinking in mathematics is an ability to think clearly and logically inspiring engagement in insightful and autonomous thinking while questioning in the mathematics classroom. Thus, critical thinking is essential when making logical connections in the construction and evaluation of arguments in mathematics lessons. Further, it helps to detect inconsistencies and common mistakes in reasoning while solving algorithmic mathematics problems systematically through the identification of the relevance and importance of key ideas. Critical thinking requires the justification of one's own beliefs and values through a cycle of questioning and answering. Hence, when students engage critical thinking as a mode of questioning in the study of mathematics, they are likely to internalize their new understanding and generate new thoughts because their thinking is focused on a set of innovative questions which become a tool of insight. Mathematical content is changed into mathematical thinking resulting in critical thinking skills within the mathematics classroom and transference. At every level of classroom differentiation, mathematics teachers need to purposefully plan questions, clearly

articulate context and purpose, determine relevant information through discussion, analyze key concepts, generate sound rationales, recognize questionable assumptions, trace important implications and think empathetically (Dunn, 2010). Clearly then, critical thinking is not simply a matter of accumulating information in the mathematics classroom through recall. Rather, a critical thinker can source relevant information and reach conclusions from an analysis of known facts to solve algorithmic mathematic problems. Critical thinking is hence a key higher thinking skill necessary for 21st century educational reform (Bulach, Lunenburg & Potter, 2011) and in particular in mathematics classrooms, creates a thought-provoking environment that engage students and their teachers in high order thinking practice. An efficacious mathematics classroom would evidence consistent inquiry through well-informed, trustful, reasonable, open-minded, flexible and fair-minded evaluation that is not subject to personal biases and reflects informed judgment and a willingness to re-think. Critical thinking results in clarity about issues raised and the use of logical reasoning in criteria selection of when completing complex tasks, critical thinking in mathematics assists in knowledge acquisition but more importantly through investigation and a cycle of inquiry achieves precision in mathematical thinking.

Use of questioning in the mathematics classroom. In today's mathematics classroom, teachers face ever increasing pressure to create a suitable learning environment in both an efficient and effective manner to engage learners in the pursuit of good results. If pedagogical design lacks a structured plan to use questioning as a mathematical learning tool, opportunities to generate the type of lively and interactive dialogue that encourages an environment in which students actively analyze and process information to answer good questions, will be missed. The use of a variety of questions for a range of applications in the mathematics classroom, expands and enhances the level of higher order, critical thinking and learning and real world application beyond the classroom. Similarly, questioning and thinking initiate the planning of information and ideas which, in turn, provides an opportunity to develop new ideas and understandings in mathematics classroom. Experientially speaking, this study determined that the questions used directly correlate to student performance when engaged in high stake assessments and hence the stage of questioning reflects the stage of thinking in terms of cognition (Beyer, 2000). Commonly, the teacher does most of the talking in a mathematics classroom (Treffinger & Isakson, 2001; Dahal, 2017). Any effort to encourage questioning skills must begin with an increased emphasis on providing students with adequate time to imagine and to prepare adequate responses to share with their peers (Blosser, 2000). The clarity of the goal of a question helps to articulate the purpose of the question to be asked (Anderson, 2001).

However, the solution to higher order engagement in mathematical thinking is not simple as just deciding to ask more questions during the course of a lesson. First author would suggest that mathematics teachers needs to reflect on the nature of the questions they use and actively plan to implement the use of questions as part of their lesson design. Through feedback and reflection mathematics teachers can focus their learning and make pedagogical choices about how to be pose their questions to best fit the identified purpose of the learning. In a similar fashion, Clarke (2006) posited the idea that the level and types of questions should be designed to elicit student reflection on their ideas and reactions to the topic at hand. Additionally, referencing to the work of Perrott (2012), it is evident that one of the common problems in designing and facilitating a questioning sequence is the

lack of understanding with regard to how and when to alternate between lower and higher order questions in the mathematics classroom. This research found validity in Seime's (2015) claim that without a strategy that specifies an objective or end in view as a learning goal, there is no logical basis for developing or selecting a questioning strategy. Mathematics teachers need to develop capability with the procedure of outlining questions so that they can direct students in the learning process (Eggen & Kauchak, 2006). According to Eggen and Kauchak (2006), good questions are clear, purposeful, brief, sequenced and thought-provoking and have been accepted by and modified to the diverse levels of ability in any mathematics class. Farrant (2008) further adds that when used effectively, questions help stimulate students to compare, conclude, infer, predict, apply, relate, design, generalize, probe and solve algorithmic mathematics problems. The narrative inquiry used throughout this research determined that critical thinking provides a scaffold or ladder which students can scale or climb to achieve a fuller and deeper understanding through the use of questioning.

Categories of questions. While questioning, teachers promote mathematical discussion to elicit student opinion. Harris (2000) summarizes some of the purposes of questioning as: checking student understanding, initiating discussion, inviting curiosity, beginning an inquiry, determining student prior knowledge and stimulating critical thinking. In addition, teachers also ask questions in anticipation of or for the specific purpose of gauging student opinion through responses. Woolfolk (1989), examined both lower and higher cognitive domains in describing questions and proposes categorizing questions into convergent questions with one correct answer and divergent questions with many possible answers. Further, Cunningham (1987) published an extensive list of questions where convergent and divergent questions are separated into low and high level subcategories finding that based on the cognitive level of the student responses; low-convergent questions required students to convey information by comparing, contrasting or explaining. In contrast, high-convergent questions required students to support their reasoning and draw conclusions. Also, while low-divergent questions could involve solving a problem in a different manner high-convergent questions might encourage students to elaborate, point out implications or predict. There is a place for both questioning levels – low and high divergent in that they invite students to cognitively think about and process information in different ways. In fact, Hiebert and Wearne (1993) identify four types of questions: recall, description of the strategy, generation of a problem and examination of underlying features when they examine the types of questions asked by teachers. Similarly, Barnes (1990) cites three categories of questions that transpire in the mathematics classroom: factual questions which requires the recall of facts, reasoning when constructing a logical argument, and open-based questions. With the help of this framework, Vacc (1993) further analyzed and explored factual questions and determined that open category knowledge focused questions will attain information about their students' understanding. In this study then, the aim was to identify the types of questions teachers asked their students with the hierarchy acting as a further categorization. Bloom's taxonomy (1956) is one of the most relevant hierarchies in this context, where questions are labeled from simple to complex, and the cognitive objective is the most widely used hierarchy. However, Wolf (1987) introduced a different hierarchy, which addresses the selection of challenging questions after classroom observation. This hierarchy started with Bloom's six levels of questions and added five further categories at the higher levels of thinking. These categories include: inferential questions, asking

students to go beyond immediately available information; interpretation questions, asking students to fill in missing information; transfer questions which focus on the consequences of information gathering; hypotheses questions which ask students to think about what can be predicted and tested and reflective questions which ask students to ponder on how they know what they know. Table 1below summarizes the type of teacher questions found in the literature.

Table 1: Summary of Teacher Questions in Literature

Questions of Comparison Type	Authors		
	Cotton (1989)	Cunnigham (1987)	Woolfolk (1998)
Dualist	Convergent: Low: predictable transfer of information High: encourage reasoning Divergent: Low: think of alternative ways to do something High: encourage creative thinking	Low: recall information High: manipulate information to create an answer	Convergent: one right answer Divergent: many answers
	Vacc (1993)	Hiebert and Wearne (1993)	
Category	Factual-name specific information Reasoning- develop one or more logically organized responses Open- have a wide range of possible answers	Recall- give known information Describe strategy-explain solutions Generate problems-extend thinking to new areas Examine understanding features- generalize ideas	
	Bloom (1956), Androson (2001)	Wolf (1987)	
Hierarchical	Remembering-recalling information Understanding- demonstrating understanding of information Applying- uses information to solve a problem Analysing- making reference Evaluating- Divergent, original thinking Creating- Judge the merit of ideas	Interpretation- understand consequences of information Inference-go beyond available information Hypothesis-predictive thinking Transfer- take knowledge to new areas Reflective-explaining how you know	

(As cited in Ilaria, 2009, p. 34)

In Table 1 above, the researcher who defined the specific question types is identified and the types of teacher questions are defined by their anticipated (see table 1) student response: low and high cognitive levels, categorical types, and hierarchical

student thinking levels. The narrative inquiry methodology used in this study explores the actual teacher question types used by six mathematics teachers of Kathmandu Valley.

Theoretical Perspectives

Using narrative inquiry as a method to explore the perspective on how questioning skills are being used in the mathematics classroom, this study examined the foundational beliefs and understanding that inform how mathematics teachers use questioning in teaching and learning practice to make the theoretical standpoint clear. This research article uses the following learning theories as theoretical referent tools.

Behaviourism. Behaviorist learning theories highlight the changes in behavior that result from stimulus-response associations made by students in the mathematics classroom. Even today, there are still instructional approaches that many mathematics teachers use in the mathematics classroom which correlate with the behaviorist learning theory. Mathematics teachers uses various methods to control behavior within the mathematics classroom. Questioning is an example of behaviorist applications used in the mathematics classroom by mathematics teachers to control or engage students in learning. According to Orey (2001), mathematics teachers use these strategies to ensure that their classrooms run smoothly and effectively. In this research article, the instructional strategy of questioning in mathematics classroom has been found to enhance student acceptance of the relationship between attempt and success by addressing their attitudes and beliefs about mathematics learning in the classroom through questioning (Pitler, Hubbell, Kuhn & Malenoski, 2007). The attitudes and beliefs about effort and learning that students acquired through repetition and a behaviorist approach are a clear example of how questioning can still be used in today's mathematics classrooms. One way that students can change their outlook and attitude is through questioning in the mathematics classroom (Pitler, Hubbell, Kuhn & Malenoski, 2007), thus behavior and effort go hand in hand. After examining the behaviorist learning theory, we now understand how questioning strategies are employed in today's mathematics classrooms. There continue to be many instructional strategies that correlate and coincide with behaviorist principles, no matter what learning theory is used and thus behaviorist theory in questioning in the mathematics classrooms, continues to be useful.

Constructivism. Though it began as a theory of learning, the constructivism pedagogical framework has made an impact on education particularly in teaching and learning mathematics through questioning (Treagust, Duit & Fraser, 1996). A constructivist view of learning emphasizes that students construct their own knowledge using their own prior knowledge and experiences while questioning (Gunstone, 1995). As a theoretical referent, constructivism has embraced the four essential criteria to characterize constructivist teaching practices while questioning in the mathematics classroom namely: obtaining prior knowledge, creating a cognitive gap, testing the relevance of acquired knowledge through feedback and reflection on learning. Using these criteria is an accurate measure to determine whether certain pedagogical practices are worthwhile while questioning. As a narrative inquiry researcher collecting and chronicling mathematics teachers' stories (i.e., experiences), the activities first author involved in (e.g., forming research questions, making sense of teacher's experiences on questioning, writing the research report) are intentionally framed. Constructivists have a

tendency toward questioning during mathematical instruction and can be seen to have an active role in the relationship between how students learn and how teachers teach.

One fundamental principle of constructivism is that students keenly build knowledge, rather than merely memorizing ideas presented, through structured teacher questioning techniques. Piaget proposed that through questioning, students were not mere recorders of information, but rather builders of knowledge structures. In a learning environment where students are held accountable for their own learning and teacher questioning is the focus it was found that teachers value student thinking, initiate lessons that foster learning, provide opportunities for students, structure learning around primary concepts, and facilitate authentic assessment of student understanding. Constructivist theory then entails that students create their own knowledge both individually and collectively through teacher questioning. The mathematics teacher responsibility is to foster the environment, pose the challenge, and offer the support that will support the cognitive construction of knowledge through questioning. In the constructivist classroom, teachers model mathematical thinking behavior, initially as experts guiding student activities and through gradual release, allow increased responsibility altering student participation in group discussions and facilitating meaningful learning about the subject matter through questioning (Hill & Flynn, 2008). Hence, constructivism views of mathematics teacher questioning highlight that the practices by which students create, build and extend meaning should not only match but also challenge student understanding, encouraging further growth and development of mathematical intelligence. Constructivism is helping transform pedagogical practice across a range of subjects through focused teaching and learning techniques. In constructivist mathematics classrooms teacher questions encourages problem-solving and concept development where the construction of learner-generated solutions and algorithms are stressed rather than drill and practice on correct procedures and facts to get 'the right' answer

Social constructivism. Currently, constructivism is defined as how humans (i.e., teachers and students) learn and acquire knowledge individually by questioning. In contrast, social constructivism focuses on the significance of social interactions (e.g., classroom) and the role of culture in creating knowledge. Further, the constructivist emphasis is on the individual (e.g., teachers or students) experiences whereas the social constructivist emphasis is on social (i.e., classroom) interactions and culture. When examining communication between mathematics teachers and students in a mathematics classroom, the transference of ideas of cognition alone cannot completely describe the learning that happens with the help of social experience. The theoretical referents of social constructivism provided a clear outlook in this research on the higher cognitive processes that can expand through social interaction for understanding and the uses of questioning in the mathematics classroom. Although many scholars in mathematics instruction generally support a constructivist view of pedagogical culture, there are differing perspectives about the components involved in the learning construction process. In this narrative inquiry, a theoretical referent of social constructivism was researched, this emphasized the idea that knowledge of a particular experience is produced and maintained through communal human action, thought, dialogue, or other social practices. To some extent, this theory posits that learning occurs through the community of mathematics activity and a sharing of the mathematics classroom culture. Vygotsky

(1978), a seminal author in the field of cognition theory, stated that higher cognitive processes develop from social interaction.

In this narrative inquiry research, of particular interest was the understanding and use of questioning in mathematics between mathematics teachers and students as they construct knowledge of mathematical phenomena throughout the classroom and specifically the use of teacher questioning. This theory has a main motto, that students' engagement is a process of cognitive growth as they explain mathematics problems or tasks and construct mathematical facts, so questioning and connected theoretical frame transfer seamlessly to the field of mathematics. When learning the cognitive progress of students in the field of mathematics, it is empathetic to think in terms of cognitive illustrations of mathematical ideas. Students create more mathematical meaning by themselves through the use of interpretive activity. In similar fashion, Bauersfeld (1992) also states the significant need for children to develop constructive competence through social interaction with their teacher and classmates inside the mathematics classroom. He recommends negotiation of mathematical meaning between teacher and students through the classroom questioning, solution of the tasks and learning by contrasting with illustrations and discussion of underdetermined tasks. Similarly, students progressively mathematize their experiences with the teacher's initiation and guidance (Cobb et al., 1992). Teachers in mathematics classrooms serve a similar navigator's role thereby helping students navigate between everyday understandings and the world of mathematics as the transition to the concepts, symbols and practices to real world community mathematics in relation to questioning techniques.

Sociological perspectives. Sociology studies human society and social behavior through social interaction and social phenomena (Schaeffer, 2011). So, a sociological perspective entails a perspective on mathematics teacher behavior and its connection to the classroom as a society during questioning. A sociological perspective invites investigation into the connections between the behavior of mathematics teacher and the structures of the classroom as a society. A sociological mindset entails an ability to connect individual (e.g., mathematics teachers) experiences and societal (e.g., classroom) relationships through the process of questioning in the mathematics classroom. An awareness of the relationship between the individual and the wider society, both today and in the past" (Schaeffer, 2011) connects history (i.e., past) and biography (i.e., current personal experiences and context). The lens that an individual (e.g., mathematics teachers) chooses to view the scope of society from informs their perspective of a classroom, going beyond the obvious to question what is accepted as true or common sense. We used sociological perspective in this inquiry to determine general social patterns of the behavior of mathematics teacher while questioning in the mathematics classroom and to offers insights about the social world that extends far beyond explanations that rely on mathematics teacher's quirks and personalities. Further, we used it to emphasise the fact that the mathematics classroom is not about solidarity or social consensus but about the potential competition inspired through questioning.

Method

In this research article, narrative inquiry was used as a research method (Clandinin, 2013) because of its validity as a methodology to study experiences of a phenomenon as told through stories. In this article, the narrative inquiry was used to

capture teachers' experiences of questioning in mathematics through interviews (Creswell, 2007) and to develop personal stories of teachers' understanding and use of questioning in mathematics during teaching in their classroom. Interviewing, recording and analyzing teachers' reflection concerning their questioning interrogated their experiences in secondary school mathematics teaching and provided insight. The experience-centered approach, a focus taken on retelling experiences as student and teacher that is recalled as highly motivational, is used in this article to support teachers' experiences as personal "truths". There is no 'cookie cutter' or singular right way, to conduct a narrative inquiry study (Dahal, 2017).

This research was carried out to describe, analyze and interpret the culture of questioning in mathematics classroom from various perspectives of mathematics teachers from the Kathmandu Valley. For this purpose of the study, a criterion-based selection strategy was used to select participants to be involved in the research (Roulston, 2010). Criteria based selection was used to ensurine that the best participants were selected on the basis of their ability, knowledge and understanding of the use of questioning. In the study, it was important that each of the participants told their stories of the phenomenon under study (Creswell, 2013). To recruit teacher for the study, twenty secondary mathematics teachers' having at least five years of mathematics teaching experience (e.g., twelve from private and eight from public schools) were interviewed over the telephone and given details about the study. The study was briefly outline and successful participants were scheduled to allocated time for an initial interview, follow-up interview and telephone inquiry for further meaning-making. After six days, six teachers: four from private and two from public schools were ready to be research participants. These six mathematics teachers had their first conversational interview. While qualitative research inquiry that uses narrative inquiry is generally likely to have one or two participants (Clandinin, 2013; Creswell, 2014), given the research timeframe six narrative stories were developed via research involving six selected mathematics teachers.

In this inquiry, for this article to represent the narrative stories (i.e., questioning experiences) of six research participants and the researcher as co-constructed stories of understanding about the use of questioning in the mathematics classroom, "entry and exit" identification has been used to present the narratives. Additionally, each story has been analyzed and interpreted such that the narratives relate to different theoretical perspectives and practices for meaning-making (Mitchell, 2011). The narrative data was analyzed using an experience-centered thematic approach. A further interpretive review intended to search for ad record the various perspective of teacher questioning was conducted. Teachers' stories are presented under general themes and individual teachers' views in questioning were collated. Teachers' values, personalities and personal interests are seen within the data collected. Six interviews of mathematics teachers became the first set of themes or 'nodes' created (Riessman, 2008). As the narrative story unfolded, possible meanings emerged behind what each teacher was sharing. After the themes were listed as nodes, portions of interviews relevant to each teacher's narrative were identifiable and later tagged or attached to the relevant themes they addressed.

Discussions

Based on the developed research question and constructed methodological map, this section discusses the spirit of the research. The stories of six mathematics teachers

from five different schools of the Kathmandu Valley have been constructed. Two of theses stories are presented here:

Entry with Rebina's story. *She completed her SLC level from Kanya Ma. Vi., 10 +2 from CCI (Classic College International), and a Bachelor in Microbiology from Amrit Science Campus, Nepal. Now, she is studying a Masters Degree in Sociology at Tri-Chandra campus. She started her teaching career at Pragati School where she worked as a mathematics and computer teacher from grade 5 to 8. Recently, she has been teaching mathematics at the secondary level (i.e., grade IX, X) at Aksharaa school.*

She started her schooling at the age of five. She was a favorite student of her teacher because of her eagerness in learning mathematics. There was no specific subject as a preference for her during her schooling because she was talented and was able to secure good marks in all the subjects, however she selected mathematics as her field of strength. Her teachers' continuous encouragement and habit of questioning on the problematic topics made her more accurate. According to her, "The questions asked were more related to recall questions from algebra, understanding questions from arithmetic and organizing existing knowledge from geometry to experience in order to create new understanding and meaning". She never needed tuition classes in her school life because of her independence and hardworking habits, along with the expert support of her teachers who played a positive role even in the absence of the internet.

At that time mathematics was considered a hard subject but she never realized it because she was interested in mathematics. At the secondary level, her mathematics teacher was also her class teacher who used to ask algorithmic mathematical questions from practice books and question banks in addition to textbook exercises. According to her, "In the fractions, Rebina's teacher used to ask algorithmic mathematical questions like 'find a fraction that is less than $\frac{4}{5}$ *but greater than* $\frac{3}{5}$*, what the missing fraction might be?* $\frac{....}{....} < \frac{4}{5}$ *etc". Thereby, her mathematics teacher used to ask questions as follows: does anyone have the same answer but a different way to explain it? Would you ask the rest of the class that question? Do you understand what they are saying?, Can you convince the rest of the class that your solution makes sense? Can you give me an example of …….?. There was no support class in her school. So, she used to discuss and practice with her friends and also she used to support her classmates and juniors.*

Her father was the first positive catalyst for her foundation

n in mathematics because he used to question her all the time. She said it is hard for her to remember all those questions now, but she tried to recall some that were asked during her home assignments: how does this relate to your topic? What ideas that you have learned before that were useful in solving this problem? Have you ever solved a problem like this one before? And what are the similarities and differences between your methods of solution and how would I support you now?, etc. which helped her better develop her foundation in mathematics. She was also inspired by her teachers in school. She said, "My first lesson of mental mathematics began from my home". In addition to this, mathematics was the main subject that helped her secure good marks and upgradds her total percentage so she always tried her best. Her school provided her with an

opportunity to teach juniors after her SLC (Schooling Leaving Certificate) out of respect for her talent and teaching quality, which later on proved to be a further strong foundation of her teaching career. Due to her inexperience during that period of time, she could not remember algorithmic mathematical questions properly but could recall some and used as an example that while she was teaching shapes in her mathematics class, she asked questions like: Does a square not always have four sides?, Is the product of 2 x 3 not equal to 6?". Further, she stated that these questions really do not require an answer. Her intention was to engage students in discussion when she asks why? How do you know it? Can you explain it? and Can you give an example?

During her school days, she was often asked hard and tricky questions by her mathematics teacher and was provided time to think and solve these questions in the classroom where she was awarded status due to her talent. The questions from algebra were e.g. 'if $a^b = c, b^c = a, c^a = b$ *prove that abc = 1'.Although she could not remember all the questions her teacher asked, some that she remembered are 1) Did you understand today's topic? 2) How many do you still not understand, I'm here to support you? 3) Do you need further help on this topic? Is there another way to solve this problem? Is there any easier way to solve this problem?, etc.*

She said, "Our teacher used to ask algorithmic mathematical problems of grade 10 when I was still in grade 9". She hardly remembers the questions her teacher used to ask them, but some that she could recall are: Is that true for all algorithmic mathematical problems? Could you explain it? Can you think of a counterexample? How could you prove that?, and What assumptions are you making?. She realizes that her teacher practiced questioning to upgrade student mathematical knowledge. During her school days, as there was no practice of printing or photocopy, the algorithmic mathematical problems that were out of the textbooks were written on the blackboard and assigned for practice.

Her teacher had categorized the class into three levels according to performance: the upper level, average level, and lower level and questions were asked accordingly. Obviously! the interviewee was asked hard algorithmic mathematical questions: more subjective and word problems and other oral and discussion questions because she was one of the talented students in the class. She realizes now, her mathematics teacher wanted 100% marks from those who secured 90% and more. She said, "We have studied mathematics, sir, but not by using real material and connecting to real life, as is done nowadays". We only used to study mathematics to secure good marks in the examination. Our teachers used to focus on the specific topics from the curriculum which was more important from the examination point of view with regard to algorithmic mathematical problems.

Finally, according to her account, her University education was not very different from that of her school. However in university, she was not free to ask questions, rarely receiving a reply from course facilitators when she did and hardly remembers any questioning by course facilitators.

She started her teaching career around six years back. She enjoyed solving algorithmic mathematical problems so she chose mathematics for her teaching profession. She said, "To teach mathematics is not only to teach someone but is also an opportunity to gain innovative knowledge". She is trying to teach her students by making use of local available real materials and connecting them all with real life. She added, "My teaching practice is evaluated on the basis of how much students can link it to their real life". I take it to be my proud moment when I see them connecting their learning skills to their real life". We have to base our teaching on the curriculum set by the government of Nepal. So, I prefer teaching my students from the examination, exploration point of view.

Further, she said, "I teach mathematics by connecting it to real life along with melding it with this examination/investigation point of view". She makes her mathematics class active by posing some questions in between like, 'Do you see a pattern? Explain it in your words now? What are some possibilities here? Can you predict the next one in this pattern? What about the last one? How did you think about the problem? What decision do you think he/she should make?' etc. In addition to checking students' answer sheets, she asks one of her students to solve the given algorithmic mathematical problems on the whiteboard and as she is familiar with peer checking, she asks her students to check their peer's copy, too. She shows her students the marking scheme of each step in mathematics solutions on the whiteboard using a student sample as a reward for that student's good work and participation. In her experience, this method of bridging the teaching-learning process helps to fulfill her objective but the allocated time is generally insufficient. She enjoys it when her students ask questions in between the classes. She said, "Her students used to ask questions like 1) What is the main process of this algorithmic problem ma'am? 2) Where is this topic/formula connected to real life ma'am? 3) Is there another process of solving this question, ma'am?" Further, she never expects answer based questions of the algorithms from the students in her class.

At the beginning of her class, she asks relational questions to her students like "How are you all?" If someone was unwell in her class, she used to give more attention to him/her and kept inquiring all the students if they have any confusion regarding the previous class. She helps her students if they came up with any kind of confused topic in her leisure time and only after she was convinced that there were no problems left, she went forward with another topic. For instance, if she was to start the topic "Fraction", she asked the following questions as warm up and allowed them some time to think. 1) Can you tell me about the topic? 2) How many of you have heard about this topic? If you have, please share your views. 3) Have you studied this topic in your previous grade?, etc. She did this all to access their prior knowledge and in-depth understanding. Further, she shared her experience on the topic "profit and loss" where she asked questions like: 1) Have you heard about profit and loss? 2) In which price does profit take place? 3) Can you give some examples, please? After the students respond, she starts to teach "profit and loss" connecting their answers to the previous discussion. In between the class time, to check their concentration, she requests one of the students to complete the remaining solution on the whiteboard. For further confirmation, she often posed questions like, 'How many of you have understood that? Did everybody see that? Do you want me to repeat? Do you have any questions regarding the process? What do you do?' The questions were often connected with their name and their daily life. She commented, "I

used to ask 'yes/no', 'how' and 'why' types of questions and I used to focus on 'why type' of questions a lot".

At the end of the class, she asked the following questions: 1) Do you have any queries or confusion regarding this process? Please ask your parents about profit and loss - I expect at least two examples from each of you.

She has been researching the types of questioning skills in mathematics that would both increase teacher's satisfaction and the student standards. From her experience, there should be different levels of questions for the diverse needs of students. She stated, "Talented and active students can solve any type of question but there should be an appropriate level of questions for the students who are weak and somewhat disinterested in mathematics". Finally, she added that mathematics should not be a difficult and terrifying subject for less talented students.

Re-entry with Rebina's art of questioning. *Reflecting on Rebina's story, she describes herself as a hardworking, well-respected mathematics teacher in her school. Her experience with questioning from her childhood initiated with her father who was the first positive catalyst for her to build up the foundation of mathematics because her father used to question her at every step of her mathematics solution regarding whether the ideas that she learned before were useful in solving the problems in the current context or not and whether she had ever solved similar problems? He questioned what was similar and different about her method of solution and which problems she needed her father's support with? The relationship between attempt and success affected her subsequent attitudes and beliefs about mathematics learning through questioning (Pitler, Hubbell, Kuhn, & Malenoski, 2007, p. 155). Therefore, it could be said that Rebina is relatively lucky with regards to questioning practices. However, at the time of the interview, to some extent, she had an assumption that questioning was limited only to the algorithm mathematics problems (Lubienski, 2000).*

Rebina focused her narrative more on algorithmic mathematical questions rather than on her art/nature of questioning in mathematics classroom practices. In contrast, she emphatically added, questioning by her teacher in the mathematics class was more like recall questions from algebra, understanding questions from arithmetic, organizing existing knowledge from geometry to experience in order to create new understanding and meaning on the confusing topics (Hiebert & Wearne, 1993). In this way, Rebina emphasizes, her mathematics teacher's continuous support in the mathematics classroom and her hard-working habit became always positive for her to empower her understanding. Similarly, Rebina's hardworking habits reinforced her beliefs in drill and practices which are strongly driven to behaviorism. As, Rebina is aware, mathematics is a hard subject. She believes that her teacher asked the algorithmic mathematical questions from the practice book and question bank for some of her friend and different questions were labeled from simple to complex (Woolfolk, 1998) with many of her friends getting asked fewer questions than her. She acknowledges that her student life in the school with a supportive mathematics teacher, who is also her class teacher, was good compared others and was significant to her understanding through algorithmic mathematical problems and questioning.

Rebina comments on her teacher's algorithmic mathematical questions in the context of fraction; her teacher used to ask questions like 'find a fraction that is less than

$\frac{4}{5}$ *but greater than* $\frac{3}{5}$*, what might the missing fraction be?* $\frac{....}{....} < \frac{4}{5}$ *etc'. Thereby, her mathematics teacher used to ask questions without procedural understanding and hence did not ask the following questions: does anyone have the same answer but a different way to explain it? Rebina said that she was chosen by her teacher and was asked the questions like, "Would you ask the rest of the class that question? Do you understand what Rebina is saying?, Can she convince the rest of us that her solution makes sense? Rebina, can you share an example of …….?". Rebina was motivated to struggle to find the solution as she was a talented student, the problem solving strategies with various processes in any particular solution developed. She outlines the 'rules' which apply to find out the solution (von Glasersfeld, 1995) and which was valued by mathematics teachers*

Rebina reports that when teaching shapes in her mathematics class, she asks questions like, "Does a square always have four sides? Is not the product of 2cm x 3cm equal to 6cm^2?" Indeed, Rebina's strong intention is to engage students in discussion by asking very basic questions (Cotton, 1989) which encourage students to learn mathematics.

Adding to her narrative, Rebina continues that, she was often asked hard and tricky questions by her mathematics teacher and also provided time to think and solve. Following which her teacher would ask questions like 1) Did you understand today's topic? 2) Do you need further help on this topic? 3) Is there another way to solve this problem? 4) Is there a more easy way to solve this problem? It is strongly apparent that Rebina's teacher intention was to encourage her to find the solution. In this regard, her teacher focused on encouraging questioning to challenge students to discover their ideas, inviting students to take risks, and self-motivating their evaluating their level (Schurr, 2000).

From Rebina's narrative it can be assumed that her teacher frequently asked algorithmic mathematical problems of grade X when she was in grade IX". Thereby, posed questions like, "Is it always true? Why or why not? Is that true for all algorithmic mathematical problems? Explain? Can you think of a counterexample? How could you prove that? What assumptions are you making? Rebina realizes that her mathematics teacher wanted to upgrade her mathematical knowledge by asking various algorithmic mathematical problems followed by questioning. Harrop and Swinson (2003) state that asking good questions is one of the most important teacher skills to assist students for their better understanding of mathematical concepts.

Rebina's mathematics teachers categorized their class into the upper level, average level and lower level (Cotton, 1989). Her teacher then directed questions according to the level of the group. Rebina faced harder algorithmic mathematical questions, more subjective and more word problems. Rebina's university education was not much different from that of her school education. Possibly her university facilitator was highly influenced by Steele (2003), who describes, "I give them the opportunity to think. I am silent. I wait. I listen. I encourage them to test their ideas. I encourage them to talk to each other. I wait. I listen" At university it can be assumed the facilitator was

giving students time to think about mathematical ideas and allow for the development of their own ideas.

Rebina started her teaching career with the slogan "to teach mathematics is not only to teach someone but also the opportunity to gain innovative knowledge". I appreciate it and believe it to be true. So, Rebina tried to teach her students using locally available real materials connecting with real life. Rebina always tries to keep her mathematics class active by questioning in between the class like, "Did you notice any changes in solving the problems? Can you predict the next step? How did you think about the problem?, etc. I thought her intention here was to test the mathematical concepts taught recently.

Rebina asks questions while checking her students' answer sheet; she asked one of her students to solve the given algorithmic mathematical problems on the whiteboard and she is familiar with peer checking. So in her mathematics class, Rebina asks her students to exchange and check each other's copy making sure that they know the exact solution. She makes uses of the whiteboard to mark scheme of each step. This approach that she practices here is strongly based on behaviorism. Rebina, to some extent believes in behaviorist theory also. Rebina has actively searched for professional training on how to use questioning but the school has never provided that opportunity so rather, she researched using the internet.

Rebina further noted that she enjoys it when her students ask questions in between the classes. Rebina generally used to ask questions after completing any algorithmic mathematical questions like 1) What is the main process of this algorithmic problem? 2) Is this topic/formula connected to real life? 3) Is there another process of solving this question? In this context, Rebina's intention was to develop the curiosity of students to respond to the questions and deepen their concepts and pose questions to students with a goal of making them think (Cazden, 2001).

Rebina started class by asking relational questions to her students like how are you? so as to identify the condition of the classroom and ascertains whether the students have any confusion regarding theie previous class. Hence, teacher's relational questions can encourage students to justify their reasoning verbally (Cazden, 2001). If Rebina is going to start the topic fraction, at the beginning, she asks the following questions and allows them time to think it. 1) Can you tell me about the topic? 2) How many of you have heard about this topic? If you have heard about the topic please share your views?, 3) Have you studied about this topic in your previous grade? ,etc. Her purpose is to know the prior knowledge of the topic and encourage them to participate in the discussion. In addition, if all students are involved in sharing, teacher questioning can have a positive influence on the students' mathematical thinking (White, 2003).

Further, on the topic profit and loss where Rebina asks the questions as 1) Have you heard about profit and loss? 2) In what price does profit take place? 3) Can you share an example? Rebina starts to teach profit and loss by connecting with the answers from their response. Rebina asks the questions connecting with their name and their daily life practices. Teachers who use a student-centered model for instruction believe students are active participants in constructing knowledge as opposed to passively receiving

knowledge from a teacher questioning (Seung, Park & Narayan, 2011). Finally, Rebina has habituted 'yes/no', 'how' type and 'why' type questions with a specific focus on 'why type' of questions in her mathematics classroom. Rebina completes her class by asking, 'Do you have any questions?'

Entry with Indra's story. *Indra was born on t ward no. 3 of Phulbari V.D.C of Taplejung District, Nepal. He completed his schooling at St Joseph School, Biratnagar, with a B. Sc from Mahendra Morang and M.Sc from Patan campus. He has been teaching mathematics and science since 1994 and is an established mathematics teacher.*

His experience of mathematics during his school age is interesting. At that time, mathematics was seen as a tough subject. His mathematics teacher used to rely on exercises using formulae like, $\sin C + SinD = 2\sin\left(\frac{C+D}{2}\right).\cos\left(\frac{C-D}{2}\right), a^2 + b^2 = (a+b)^2 - 2ab$ *etc. and he had to practice on the basis of formulae. He said, "It took me many days to memorize those unknown formulae. So, we were compelled to memorize them even during our play or free time." He never understood, what 'x', 'y',* $\sin\theta$, $\cos\theta$ *and* $\tan\theta$, *etc. were. He does not have any experience of practical learning in mathematics and he found algebra and geometry terrifying. He practiced a lot, secured excellent marks in the examination but he could not relate it in his daily life. He realized this only when he became a teacher himself. He used to go to school with a bag full of books. As soon as the teacher entered the classroom, his teacher used to ask them to open the book and assigned them some task from a textbook.*

The algorithmic mathematical questions were like: 8 cm long chord is drawn in a circle having radius 5cm. What is the distance of the chord from the center? Suppose from the pack of 52 cards, a card is drawn at random. Find the probability of choosing a black card, and there are 20 students in grade IX of any school. Among them, 9 are boys and remaining girls. What is the probability of selecting girls as a classroom representative? Then his teacher used to ask some questions to facilitate them: Can you solve it? Do you need any help? Do you remember the formula required here to solve the question?, etc. His teacher helped them with one or two mathematical problems for example, and assigned the rest questions as homework. His teacher used to check the homework the very next day by marking with a cross or tick. There were many tick marks in his copy.

He recollects his past, Mandal sir was his mathematics teacher and used to assign some questions and ask the students to come up with solutions. Another day, he asked them to solve the same questions on the board. For that it was required to step out the solution step by step however when he found himself in front of the class, he got nervous as he saw a stick in his teacher's hand which made him forget all the steps at once. They were not supposed to pause or make any mistake during the process of solution, otherwise, the teacher would be disappointed in them. So, he used to discuss and practice with friends. Because of all this, he did not find his school life enjoyable.

In his university education, his teachers rarely asked any questions because there were about 200 students in a class. If there were any questions posed, they were all

generalized ones like: Can we start the new lesson today? Did you read today's topic at home? , etc. He used to recite the entire content for a better result.

He started his teaching career 21 years ago as a mathematics teacher and at the beginning, he used to teach whatever was in the book like addition, subtraction, etc. He used to punish his students as his teachers used to. After teaching for 2 years, he realized that mathematics is not a subject to be taught under pressure. He chose to change his teaching-learning practice and to teach in an enjoyable, successful environment by providing opportunities for students to express their feelings.

He remembers his suffocated school days and realizes that had he been afforded a more positive environment, he would have had a better understanding of the subject itself. He started to research how he could change his teaching techniques so as to make his students understand mathematics better. He began making use of local and no-cost materials and since fostered a classroom environment that engages students and facilitates their ease of understanding.

When he enters the classroom, he uses real world materials for teaching initially and then asks questions from the textbook when their understanding level seems to increase. For example, if he had to teach the topic 'shape', he shows the real object at first and asks the students, "What kind of shape is this? Have you ever seen any object/s like this?". Students make many mistakes initially, e.g. naming an oval shape a circle, rectangle as cube, etc. But then as he used real materials and supported the students, they were able to grasp the concepts more clearly. Further, to teach the concept of two dimensioals shapes like rectangle, area, vertex, and line he assigned different students to bring objects of different shapes and taught by connecting them so that the students could understand the concept of shape at a higher level also.

He links new knowledge with prior knowledge with the help of an example e.g.'Do you know what a circle is?' .Students respond by nodding their head 'round sir' and again he asks 'Can you draw it?' Then students draw a circle and are then questioned 'Can you show a real object that looks like a circle?' Then each of students responded with different examples like the sun, moon, coin and ring, etc. Again, he asked the students, 'What should be there to be a circle?' Students said round again. Again he asked 'Is a football a circle?', because his intention was to make them creative. Again, he asked, 'Is a t-t ball a circle?", 'Is a globe a circle?', because students had prior knowledge of the globe at this level. In addition, he asked 'Is an apple also a circle? The students discussed their responses between themselves. He made them curious and expected multiple answers from them. This way, the students would learn slowly and gradually and would never forget about the topic. Even in class two and three, he used to relate the difference between the circle and sphere by using the knitting thread. He used to tell the students that there are infinite circles in a sphere by displaying it with the help of knitting thread so that his students would understand the concept well. He did not let any stone unturned in connecting new to prior knowledge and he would ensure that students practiced a concept repeatedly.

He never understood about 'x' and 'y' during his school days. So, in his first class of algebra in grade five, he said that 'x' is a variable. And students asked," What is meant

by variable sir?.Then he replied that if we don't know the value of something, and the value may be any number that is variable, for the variable we use x, y, z. Again one student asked, 'in place of 'x', cannot we use 'an' or 'the' sir? At that time, mathematics classroom would be enjoyable because he let the students ask any questions related to the topic. He replied for those students, 'an' or 'the' also can be used as a variable but 'x', 'y', and 'z' are used as a variable and 'a', 'b', and 'c' are used as coefficients or constants in our practice. He never knew the significance of algebra despite being a mathematics teacher but he taught concrete algebra in effective ways as discussed above so, his students understood algebra easily and he teaches algebra by referencing to know objects.

In between the classroom, he observed if his students were attentive or not, for that, he used to ask, 'Do you have any confusion about the process?', 'Do you need my help?'. When a student asks him e.g., 'What is the meaning of 3x sir?' in the first instance, he told the student, "Try to find out the answer, please. Then, she replied '3 is a constant and x is a variable sir'. When students were confused in '3x' and 'x^3', even though it was not in their curriculum he tried to incorporate these concepts so that the foundation of algebra would be better for students. He would explain to the students, that $x+x+x=3x$ and $x.x.x=x^3$. Further, he explained to the students that, in place of the variable if we let $x=2$, then $3x=6$ and $x^3=8$. Hence, the students knew the exact difference between the '3x' and 'x^3' properly.

At the end of his mathematics class, he used to ask questions which made them curious so that they would also ask questions to their parents or seniors. He used to ask contextual questions like, 'Where is the use of algebra in our daily life?' and he reassured them, "Do not worry, if your answer is wrong, try to find out the answer". Students used to search and find out the answer only sometimes. Sometimes, he used to request the students to bring the materials from their surroundings. He gave at least one question as a home assignment either in the written form, oral or to search some concept or materials related to the context.

Some of his questions were rhetorical: "Where is x^2+2x+3 used in our daily life?" Further, with e.g. the rule of indices such as $x^n.y^n$ which, he thinks is an abstract mathematical idea, he used to ask the students to research on the topic and he also researched on it. In absence of a definitive answer he encouraged investigation and problem solving in mathematics, which may lead many students to enter into the research sector in their career. If he did not know the answer to any questions, he never said that was the final point/answer. There is no more about this topic in the book, he would say, but there are possibilities everything.

He faced "how and why" types of questions from his students but not any" what" types of questions. Because of students hunger for the knowledge, they always asked "how and why" types of questions but sometimes he was himself not in a position to answer them.

Re-entry with indra's questioning practices. *Indra is an experienced mathematics teacher. At the time of the interview, he seems to be well aware of the recent trends and practices of mathematics pedagogy. Indra has been facing ever-increasing pressure to create a suitable learning environment for his students. In this context, to*

encourage students, questioning is a useful tool for strengthening the level of the students' understanding. Further, in Indra's schooling, his mathematics teacher used to pressurize to memorize formulae of trigonometry, requested that they open the book and assigned questions to be solved. It took many hours to memorise unknown formulae and to understand how to complete the exercises. When Indra started his teaching career, he followed the same procedure largely guided by the notion of behaviorism where reality exists independently of learners and knowledge is received exclusively through the senses (McInerney & McInerney, 2010).

When Indra started his teaching career, he used questioning techniques such as," Can you solve it after completing the questions in the example? Do you need any further help? Can you remember and are you able to use a formula to solve the question? Howevre, when his students failed to relate any mathematical concepts, Indra realized, mathematics is not a subject to be taught under pressure and it is not a transformation of knowledge from head to head. So, Indra thought to change his teaching-learning practice. He started to teach in a fun-filled and pleasing environment by providing opportunities for students to express their feelings. He also provided room for asking and responding to questioning in his classroom.

In the beginning of his teaching career, Indra seems to be a traditional mathematics teacher, he teaches whatever is in the book such as addition, subtraction, etc. He punishes his students as his teachers did. Indra takes the full authority to ask the questions whether the student is ready or not. A traditional mathematics teacher he was conforming to accepted behaviors and established practices. Indra never realized in his early career that democratic practices had started in mathematics classrooms. In contrast, Saha (2002) argued, students should be empowered to participate democratically in the mathematics classroom. Thus, students feel free to ask and respond the questions, wherever they are confused on any topic of mathematics. Indra is well aware of democratic practices after two years of his teaching career and changes his behavior and views.

Indra no longers conform to prevailing ideas or practices while questioning. Indra provides opportunities to the students to respond the questions asked by him. Indra's mathematics classroom practices as a student were sophisticated. Mandal sir was his mathematics teacher who used to assign some algorithmic mathematical questions and asked him to come up with solutions and requested Indra demonstrate on the blackboard. Indra used to recite the solution step by step but he was able to make it correct on the blackboard because of multiple reasons such as timing, relating to day to day life, etc. Indra at the beginning of his teaching career followed the same patterns however now, Indra provides time to think and requests that the students try it on the whiteboard if the solution may not be correct. He never minds errors but advises his students to try in different ways. Indra is now a highly constructivist mathematics teacher. So, Indra claims that a student's knowledge is constructed by herself or himself inside and outside of mathematics classroom. As a student, Indra did not have any experience of practical based mathematics lessons. Some questions remained answerless, such as where does x^2+2x+3 *exist and where would use it in our daily life. Now, as a mathematics teacher, for these types of questions he asks the students to research the topic and intends that he inspires some to becomes researchers. If Indra does not know the answer to any*

questions he never says that it is the final solution, he says that there are possibilities in everything. Through questions techniques Indra mathematics teacher practices improved (Lunenburg & Potter, 2012), he created a more conducive classroom and started teaching mathematics using local and no cost materials. His classroom environment became enjoyable and students became interested and started to understand easily and ask and respond to the questions posed whenever they were confused.

In his class, Indra asks questions ranging from recall, to description, to generainge a problem, and examining underlying features (Hiebert & Wearne, 1993). Indra adds that there is no limit in asking the questions as per Cotton, Cunningham, Woolfolk, Vacc Hiebert and Wearne, Bloom and Wolf (Ilaria, 2009). During his student life, Indra never understood what 'x' and 'y' were and never asked the question to his mathematics teacher because he felt uneasy to ask a question as this practice was not common.

In between the classroom, Indra observes if his students are attentive or not and hence Indra asks questions like, "Do you have any confusion about the process?'Do you need my help?' to make his class and students active. Indra further, at the end of his mathematics class, asks questions which make them curious so that they would ask those questions to him, their parents or their seniors. Hence, Indra asks contextual questions like, "Where is the use of algebra in our daily life?' and Indra is so flexible now that even if a student's answer is wrong, he suggests the correct answer.

The stories of the research participants were synthesized and the following themes developed:

Awareness about classroom questioning in mathematics. To begin with, there would be agreement among mathematics teachers that questioning is an essential skill for efficacious teaching and that teachers' lack of knowledge may prevent them from being good at asking questions. Improving their knowledge of useful skills to ask questions would emphasize the benefit of asking questions. There are several ways of teaching the same topic so mathematics teacher have to realize this fact and discard their beliefs about ways of asking questions according to their students' capability. For mathematics teachers, being aware of deficits in asking questions would help them to take steps to fix them to improve their performance.

Democratic questioning in mathematics classroom. Mathematics teacher should realize the importance of democracy in mathematics classrooms while questioning. Even more, they should be aware of social norms and values such as equal opportunity and equal rights for the range of diverse students. Further, traditional mathematics teachers such as Rebina, Rajkumar and Lal Bahadur at the beginning of their teaching career, who were conforming to these accepted behavior or established practices, need to consider their provision of equal opportunity to their students while questioning and taking the responses. Mathematics teachers who utilize a democratic mathematics discussion approach need to model their practices (e.g., Sudha, Iswar & Indra).

Balanced incorporation of both low and high-level questions. Mathematics teachers need to appreciate that a good lesson or test must have balanced inclusion of both low and high-level questions and that this necessitates the selection of questions that give

emphasis to major position and encourage lively dialogue. In general, there are two types of teacher questions in mathematics classroom found in this study namely: low-level and high-level. Low-level questions are also called closed, direct, knowledge and recall questions. On the other hand, high-level questions are open-ended, interpretive, evaluative, probing, inferential, emerging and synthesis-based. Thus, giving questions which slot in both lower and higher levels would facilitate learners practice in both categories and also help them to answer accurately. Thereby, lower-level questions are those asked at the stage of remembrance, understanding and simple application levels of revised Bloom's taxonomy. Higher order questions are considered important for encouraging students to think critically in the mathematics classroom. Higher-level questions require analyzing, creating and evaluation skills. In this inquiry the most beneficial approach was seen to incorporate a range of all higher order and some lower order thinking questions.

Planned and emergent questions. Planning questions is very important in mathematics lessons. Therefore teachers must plan their questions prior to entering the classroom. If they plan questions well in advance, they would reduce making mistakes in formulating questions and would be clear about the rationale of asking questions. Similarly, development of questions and questioning help mathematics teachers anticipate the various nature of questions that will be asked by students in the mathematics classroom. Similarly, pre-planned questions in mathematics classrooms when included into the teaching help structure introduction of new concepts, focus the discussion on a specific topic, guide the discussion in focused directions, and identify student understanding or attitude on the topic. Accordingly, emergent questions develop from the discussion and the specific answers given to previous questions. Teachers need to be able to think fast and act positively to these questions truthfully and pose them at a suitable time in the discussion. Planned and emergent questions definitely strengthen students' understanding as reflected by the strategies noted in the practice of Rebina, Sudha, Lal, Iswar and Indra.

Conclusion

In conclusion, the information that was gathered during the study through narratives of secondary mathematics teachers would be a revelation to instruct mathematics teachers on an understanding of and the use of questioning in mathematics classroom. This research identified a variety of lenses from sociological perspectives, behaviorist and constructivist approaches to categorize questioning as per expertise, critical pedagogical perspective and algorithmic and daily life practices. The understanding and uses of questioning in mathematics among teachers (Rebina, Sudha, Lal Bahadur, Iswar, Rajkumar, and Indra) may provide a springboard for future teachers. The understanding and use of questioning as an instructional tool has been in existance since ancient times and its presence in contemporary times confirms its significance as an essential tool for teachers in the mathematics classroom. Teachers understanding and use of questioning has been improving during recent years, inspired by improvements in curricula, teaching materials, teaching methodologies and the incorporation of ICT in mathematics classroom (Newton, 2016).

A further conclusion is that while the majority of mathematics teachers seem to be conformist at the beginning of their teaching career, they were nonconformist,

becoming more flexible in their questioning later in their careers. Further, the majority of research participants asked more questions within the simple to complex level and focused more on simple (low level) questioning, claiming this encouraged students in mathematical discussion.

We found that lower levels questions asked by the mathematics teachers showed that questioning had been used in a shallow way in their lessons. According to Cotton (2004), low cognitive level questions concentrate on factual information that can be memorized easily. This type of question can restrict students by not helping them to acquire a deep, elaborate understanding of the subject matter nor encouraging them to think critically in the classroom. Therefore, teachers should ensure that they have a clear purpose for their questioning rather than just testing what knowledge is learned. Similarly, Tan (2007) asserted that high proportions of lower cognitive level questions do not encourage or guide students to formulate their own judgment by analyzing, evaluating, or creating when teachers use questioning at the lower level of cognition. In contrast, high-level-cognitive questioning engages students in the use of higher order thinking or reasoning skills. Nevertheless, effective questioning involves planning and practice and effective questions would stimulate interest in new topics of mathematics, ideas, and challenges, encouraging students to be reflective about their own beliefs, assumptions and comprehension. Teachers' skills in asking questions and sourcing questions determine the levels of their questions and capacity to relate to daily life with the types of questions they ask their students (Good & Brophy, 2003), reflecting their knowledge and beliefs pertaining to questioning and their students' needs and ability.

Teachers' lack of higher knowledge of effective questioning strategies (Morgan, 1994; Dahal, 2017) may lead them into asking questions that do not contribute to motivating their students' thinking. When teachers have more knowledge of effective questioning strategies it may lead students to a higher level of understanding. So, teachers' classroom questioning is seen to be both a helpful and essential part of the mathematics lesson. When teachers' classroom questions are not based in research, the teaching-learning process may be less successful.

This study also highlighted other factors that hindered teachers' questioning in the mathematics classroom such as, insufficient wait-time provided by the teachers, teachers' views about students' abilities and lack of students' interaction. Keeping the above-mentioned factors in mind, teachers can help to promote their questioning by anticipating words in their questions that students may have difficulties with and plan to use a variety of strategies to combat this. In addition, teachers could plan a series of questions that initiate with less difficult content and scaffold to more difficult content. Finally, the teacher should create capacity to reference to background or prior knowledge relating to the topic of the lesson before discussion and present questions with enough information to support students to think critically and formulate a meaningful answer. The teachers, whose narratives have been included in this study claimed that they knew about categories of questioning which they applied in their questioning, however their categorization of questions at various levels in their lessons seemed to be inconsistent. Thus, knowledge of the taxonomy is seen to be a useful inclusion for mathematics teachers when learning about levels of questioning.

Implications

It is apparent that mathematics teachers know some of the challenges and factors that affect questioning in mathematics lessons. However, mathematics teachers are not aware of the other challenges which they may face when it comes to questioning in mathematics. As a result, mathematics teachers in this study seem not to have developed questioning strategies that may help them in preparing the students to pass mathematics examinations. Therefore, institutions would need to conduct workshops, professional development meetings and encourage mathematics teachers to go for in-service training too. Mathematics teachers should also improve the way they utilize sources available to them, adapt their tendency to dominate classroom interaction and make their lessons more learner-centered and utilize contextually appropriate strategies while questioning in mathematics lessons.

This research study can offer some insights in the use of questioning in Mathematics classrooms, in particular for novice teachers, novice teacher trainers and educational researchers. Mathematics teachers would benefit from this research by strengthening their knowledge and understanding of the use of questioning in order to focus and improve student learning in mathematics. This research is highly significant to mathematics teacher for classroom practices in particular, in the context of solving algorithmic mathematical problems. For teachers, who have not considered questioning strategies in the mathematics classrooms, this research study will be a revelation in that it will open up questioning technique and promote more discussion among students which helps students to gain shared authority in constructing the meaning of mathematical concepts and encourages them to think more critically (Chin, 2007).

Mathematics teachers should be able to distinguish different types of questioning for their choice in designing instruction with regard to lower-level and higher-level thinking questions with reference to Bloom’s taxonomy (Andorson, 2001; Harris, 2000) and further the notion of convergent to divergent (Cotton, 1989; Woolfolk, 1989) questions and the teacher’s relative role and responsibility. If mathematics teachers could become more purposeful about the questioning they ask, they will also reflect upon their roles and the roles of their students in learning, potentially re-examining or reconstructing their belief structures in this process (Seung et al., 2011). In this way, the purpose of questioning is recalibrated to stimulate student mathematical thinking.

These findings will help mathematics teachers to become more responsive while questioning, to articulate the purpose of questions and thus the required student processes in problem-solving and prompt students to consider connections within and outside of mathematics (Polly, 2014). This research reveals that when teachers have a rich mastery of mathematical concepts and the interconnectedness between different representations and topics they should be able to ask questions that promote mathematical thinking. Similarly, this study will support policymakers and curriculum designers to embed research about the use of questioning strategies in mathematics classroom practices.

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